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ROCK EXPOSURES ABOUT ATCHISON.

By JOHN M. PRICE, Jr.

The vicinity of Atchison presents some very interesting exposures of rock formation. Within a radius of a few miles there are three or four well-developed rock quarries besides numerous quarries only partially developed.

For the sake of convenience I have prepared a section showing the geological position and order of the various formations exposed, and these I have numbered from 1 to 18, beginning with the lowest and numbering up.

Our first expedition was to the Waggener quarry, one mile south of Atchison, and situated on one of the bluffs overlooking the Missouri river. Here the lowest formation exposed was No. 8, the 20-foot limestone. Just above this came No. 9, a layer of soapstone shale, four feet in thickness. Above this was a band of limestone eight inches wide. This band of eight inches appeared only in one place, and decreased on both sides, and on one side it completely disappeared into the shale. Above this was more shale for a distance of about 20 feet. Then appeared a ridge of limestone four feet in thickness, and then more shale for a distance of from 20 to 25 feet.

From here we went to the Atchison coal mines. Here we find No. 8, the 20-foot limestone, as the highest formation. Hence it is called the cap-rock. Below this came No. 7, slate, or rather a slaty shale, having a thickness of four feet. Next was found a band of limestone 21 inches thick, and below this shale for a distance of 12 feet. A layer of limestone 10 feet came next, and beneath this was No. 3 shale for a distance of about 25 feet. Next came No. 2, the coal, averaging between 16 and 18 inches. Below this was more shale, but its depth we could not determine—it was at least 30 feet.

Returning from the coal mines, we passed an old deserted quarry on the opposite side of the hill from the Waggener quarry. Here we obtained exposures of Nos. 14, 15, and 16. This last is composed of a three-foot band of solid limestone covered by about 15 inches of disintegrated limestone. Below the limestone comes a layer of soapstone shale measuring four feet, and below this lies the sandstone. This, however, was not sufficiently exposed to obtain any measurement.

This measurement, however, we obtained in an exposure near the Gaffney brick yards. In one place it measured eight feet, but within less than half a mile it had disappeared entirely. No. 10 did not appear here, nor in any of the other exposures; and the 24 feet of shale of Nos. 9 and 11 had dwindled to only seven feet. No. 13 is the clay used by the Gaffney Brick Company, and makes the finest vitrified brick manufactured in the state.

Many other exposures were visited, but all gave substantially the same results. One in particular, about two miles north of town, gave exposures of all the formations from No. 16 down to No. 3, inclusive. All of these formations are very persistent, and especially the different limestones.

I could obtain no exact measurements of Nos. 17 and 18. The two measure approximately 12 feet. The latter is a limestone abundant in fossil *Fusulina*.

The measurement of all these exposures, from the level of the river to the drift, gives a total of 180 feet. The drift measures all the way from nothing to about 50 feet.

One interesting feature of the hills around Atchison is the frequency of

terraces. These are formed by the washing away of the soil down to a layer of limestone and the gradual wearing back of this when exposed. The same process is repeated with the clay and limestone beneath. Thus a series of terraces are formed, each resting upon a layer of limestone and sustained in place by it. These terraces are very frequent along the bluffs bordering on the river bank, but are also found further inland.

